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ABSTRACT

Three studies were conducted in an attempt to replicate previous research concluding that semantic meaning is accessed in the absence of conscious awareness. A pattern mask was used to interrupt the processing of stimulus words after 30 milliseconds; at this duration subjects were not able to identify the stimulus words or even to determine whether a word was present. Experiments 1 and 2 used a forced-choice guessing procedure in which subjects were required to guess which member of a recognition pair was most similar in either visual or semantic characteristics to a masked stimulus word. Subjects' performance was somewhat higher than chance in Experiment 1, but Experiment 2, in which half of the trials for a given subject were preceded by a row of Xs instead of a word, indicated that this result could be attributed to guessing strategies. Experiment 3 used a semantic priming procedure that did not require a conscious response to the initial prime word. Results showed the usual semantic priming effect for unmasked primes; however, no priming occurred for masked primes. Thus, these studies did not support the claim that meaning is accessed prior to conscious awareness. (Author/HTH)

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Processing Words Without Awareness

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Abstract

Three studies were conducted in an attempt to replicate previous reports (Fowler et al., 1980; Marcel, 1978, 1980) that semantic meaning is accessed in the absence of conscious awareness. A pattern mask was used to interrupt the processing of stimulus words after 30 msec; at this duration subjects were not able to identify the stimulus words, or even to determine whether or not a word was present. Experiments 1 and 2 used a forced-choice guessing procedure in which subjects were required to guess which member of a recognition pair was most similar in either visual or semantic characteristics to a masked stimulus word. Subjects' performance was somewhat higher than chance in Experiment 1, but Experiment 2 indicated that this result could be attributed to guessing strategies. Experiment 3 used a semantic priming procedure which did not require a conscious response to the initial prime word. Results showed the usual semantic priming effect for unmasked primes; however, no priming occurred for masked primes. Thus, the studies reported here do not support the claim that meaning is accessed prior to conscious awareness.

Processing Words Without Awareness

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The research reported here was designed to address the following question: To what degree is meaning accessed in the absence of conscious awareness? Evidence from several sources indicates that semantic information can be extracted from linguistic input even when the subject cannot consciously identify the stimulus. The selective attention literature showed some time ago that the meaning of a message which the subject is trying to ignore can cause physiological reactions (GSR) or interference with a semantically related primary message. More recent research has studied the behavioral effects of stimuli which are prevented from entering awareness by means of temporal masking.

Wickens (1972) presented preliminary data suggesting that if subjects are forced to guess about masked words which they cannot consciously identify, their responses will reflect various dimensions of the meaning of those words. Marcel (1978, 1980, in press) has presented similar data, and argues that semantic information is activated before visual characteristics of printed words at very short processing intervals. Marcel reports that these effects are relatively more pronounced in priming paradigms, in which indirect effects of behavior can be studied. He has found that semantic disambiguation occurs regardless of whether the priming word is fully masked (thus making it unavailable to conscious awareness) or not masked. More recently, Carol Fowler and her colleagues (Fowler, Wolford, Slade, & Tassinary, 1980) have provided independent support for these claims in a semantic priming

situation. They found roughly equivalent amounts of semantic priming with masked and unmasked prime words. Moreover, this occurred even when the primes were so fully masked that subjects could not make reliable judgments about the presence or absence of a word. Similar effects have been found by McCauley and his colleagues (McCauley, Parmelee, Sperber, & Carr, 1980), who used pictures instead of words. These types of data have been taken as support for the claim that semantic processing can occur without conscious awareness.

Because these findings are somewhat counterintuitive, an attempt at replication seemed imperative. It is important to see if such effects are robust enough to be replicated at other laboratories. We therefore conducted a series of three studies. The first two used the forced-choice guessing procedure, and the last one involved a priming procedure. In all three, the critical prime words were masked to a strict criterion.

Experiments 1 & 2

The two forced-choice studies used a list of 60 one- and two-syllable, high-frequency words. Each word was associated with a pair of recognition items, one of which was judged during pretesting to be related to the critical word either in semantic meaning or in visual characteristics (i.e., sharing common letters). Masked presentation of each target word was followed by either a semantic or a visual choice pair. Timing was controlled by a Gerbrands 3-channel tachistoscope. The critical word was presented in the first channel for 10 msec, followed by 20 msec of dark illumination. This was followed by a 4-sec pattern

mask in the second channel, which in turn was followed by the recognition pair for that trial in the third channel. The SOA (stimulus onset asynchrony) between the onset of the critical word and the mask was always 30 msec. The subject was encouraged to guess the identity of the critical word (e.g., CHEESE), then asked to indicate which of the items in the recognition pair seemed to be most similar to the critical word in either visual (CHEST/BANKER?) or semantic (MOUSE/STONE?) characteristics. (The type of decision was alternated across blocks of 10 trials for a given subject, and varied across subjects for a given word.)

Clearly, performance greater than 50% accuracy in the two-choice recognition task was above chance. We found that, on the average, our subjects were correct 53% of the time for semantic decisions, and 54% for visual similarity decisions. Considering individual performance, 92% of the subjects were above chance on at least one of the two types of decisions. The absolute levels of performance however, were not significantly greater than would be expected by chance (the Z-scores were less than 1.0). Thus, the preliminary data did not seem terribly encouraging, although they were in the direction previously reported by Wickens and Marcel. [We also tested for individual differences in this task, and found statistically reliable but modest correlations of .3 between performance on this task and both extroversion and reading speed.]

To check for the possibility of guessing strategies, a second study was conducted using the same stimuli, but with half of the trials for a given subject preceded by a control pattern (a row of XXXX's) instead of a word. These control trials allowed us to see whether subjects would have been able to do as well simply by guessing on the particular recognition pairs used. The results of this second study showed that, as expected, perform-

ance was only 50% on the control trials -- but it was only 51% on the experimental trials! Therefore, we cannot conclude that the trend noted in the first study was due to anything beyond guessing strategies. This outcome was not too surprising, since others (Marcel and Fowler et al.) also reported very small and variable effects when subjects were forced to make conscious guesses about stimuli which they knew they did not see.

Experiment 3

A third and final study combined priming and masking procedures in a design similar to that used by Marcel and Fowler. The design involved varying the masking SOA (either 30 msec or 300 msec) in order to compare priming effects in a naming latency task, when the prime was either fully masked or fully visible. If priming occurs at both long and short masking intervals, this result would suggest that meaning can be extracted before conscious awareness occurs. If, however, priming effects occur when the stimulus is unmasked but not when it is masked, then this would argue against the phenomenon of "processing without awareness".

For the stimulus items, we used a limited set of 16 target words taken from Warren (1977). Each stimulus word (for example, SPIDER) was assigned four prime types: (1) unrelated (HEAD), (2) identical (SPIDER), (3) semantically related (WEB), and (4) blank. Each subject saw 4 blocks of 16 words, with a given word occurring once in each block with one of the 4 possible prime types. For a given subject, 2 of these blocks were masked, and the other 2 unmasked. Thus, all possible masking-by-prime-type combinations were fully counterbalanced across stimulus items and partially counterbalanced within subjects.

The priming SOA was held constant at 1 sec. The masking SOA, or the time between onset of the prime word and onset of the mask,

was either 30 msec (masked condition) or 300 msec (unmasked condition). The 30 msec interval for the masking SOA was the same for all subjects. In pretesting, subjects (n = 6) were asked to make judgments about the presence or absence of a word preceding the mask at 30 msec SOA. The average probability of correct presence/absence judgments at this SOA was only slightly above chance (57%). Furthermore, no subject was able to correctly identify a prime word under these conditions, even when encouraged to do so. Therefore, we are confident that the prime words were completely masked in the masked condition.

The subjects in both masked and unmasked conditions thus experienced an identical sequence of events (word/blank - mask - target word); however, the first event could be clearly seen in the unmasked condition but not in the masked condition. Subjects were not required to make any response to the first word, only to pronounce the word following the mask as quickly as possible. Since subception has been reported (Marcel, 1980; Fowler et al., 1981) to occur only under conditions of central masking, we used a dichoptic presentation procedure. Polarized filters were arranged so that the prime word was presented only to the subject's nondominant eye and the mask only to the dominant eye, while the target word which was to be named was presented binocularly. The combination of a pattern mask, dichoptic presentation, and the short masking SOA helped guarantee that central and not peripheral masking occurred.

The results, which are presented in Figure 1, do not provide support for the occurrence of semantic priming by masked words. The figure shows mean naming latency as a function of prime type and masking condition. An ANOVA for repeated measures showed a main effect for prime type, $F(3, 51) = 4.039$, $p < .05$. However, the significant interaction term, $F(3, 51) = 3.363$,

$p < .05$, indicated that this was dependent upon mask type. In the unmasked condition, responses to target words following semantically related (439 msec) and identical (436 msec) primes were modestly but significantly faster than after unrelated primes (456 msec). The difference between unrelated and blank primes was just significant ($p < .05$). In the masked trials, however, the usual pattern of priming does not hold. As seen in Figure 1, there is no evidence that the nature of the masked primes had any reliable effect on response latency to the second word. Follow-up tests verified the lack of significant differences among prime types in the masked condition.

To summarize, we were not able to replicate previous studies in which it has been claimed that subjects have access to visual or semantic characteristics of masked words in the absence of conscious identification (Fowler et al., 1981; Marcel, 1978, 1980). We could not demonstrate that information which is not available to conscious awareness has any behavioral effects, either in a forced-choice situation or in a priming paradigm (when subjects are not required to respond directly to the masked words). Priming was demonstrated for unmasked words, however, as in previous reports (e.g., Warren, 1977).

We are planning to extend the priming paradigm using a lexical decision task, which we believe may magnify the amount of priming by forcing access to meaning. We also plan to try a response measure which involves affective information. Zajonc (1980) has argued that affective information becomes available even earlier than the denotative aspects of the meaning of a word. Affective judgments might therefore be especially likely to be influenced by words which the subject is not consciously aware of seeing. It seems at this point

that an approach comparing the variables that influence priming at longer and shorter SOAs may be more valuable than an approach which views conscious attention as a dichotomy and attempts to compare processing "with" and "without" awareness. The more general question which needs to be addressed in future research is: "Do priming effects depend on qualitatively different variables at shorter and longer processing intervals?"

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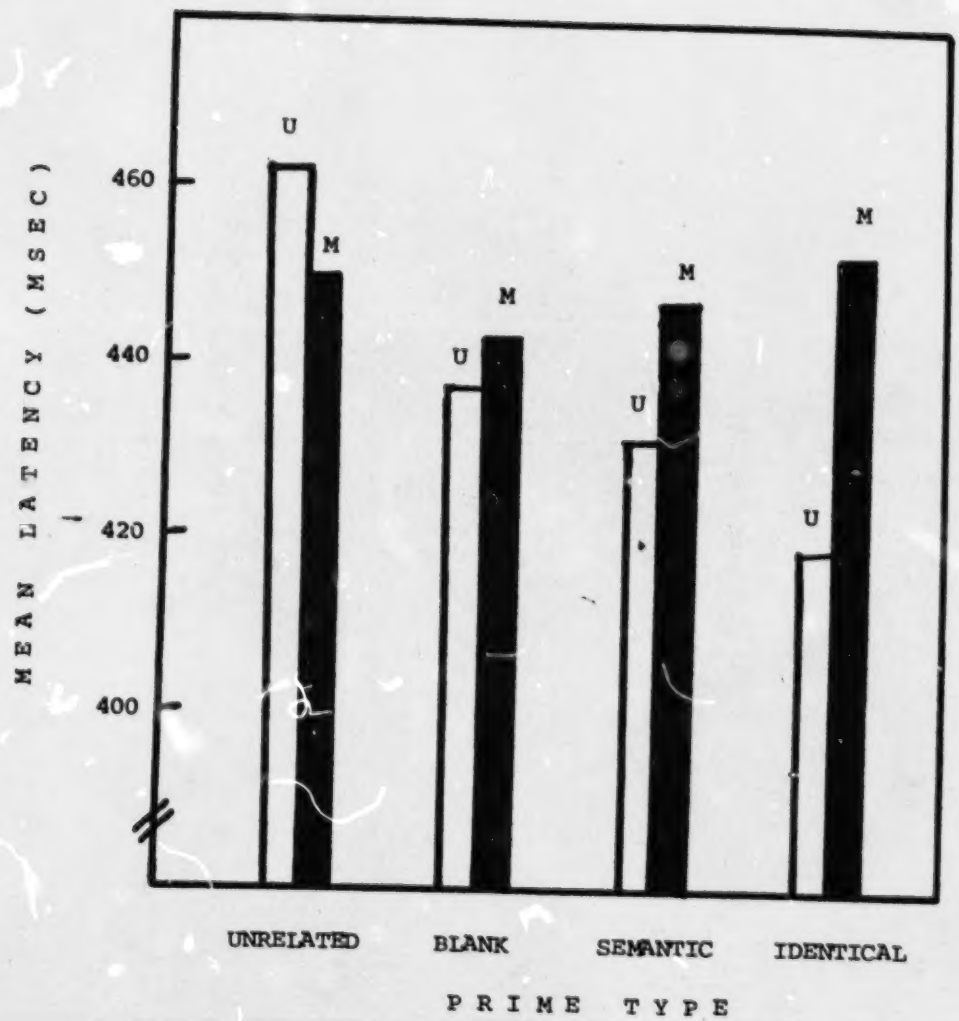
MEAN LATENCY (MSEC)
460
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IDENTICAL
PRIME TYPE